



1. Integrate

a) (5 marks) $\int x \cos x^2 - 1 \, dx$

b) (5 marks) $\int \frac{1}{x^2 - 2x - 2} \, dx$

c) (5 marks) $\int \frac{x^4}{x^2 - 2} \, dx$

d) (5 marks) $\int \tan^3 x \sec^3 x \, dx$

e) (5 marks) $\int x^3 \ln x \, dx$

f) (5 marks) $\int \sqrt{\quad} \, dx$

2. (4 marks) Use the limit definition to find the area of the region bounded by the graphs of $f(x) = 1 - x^2$ and the x -axis on the interval $[0, 1]$.

$$\sum_{k=1}^n k, \quad \sum_{i=1}^n i, \quad \sum_{i=1}^n \frac{1}{2}, \quad \sum_{i=1}^n i^2, \quad \sum_{i=1}^n \frac{1}{6}, \quad \sum_{i=1}^n \frac{2n-1}{6}$$

3. (4 marks) Find the derivative of the following function

4. Find the following limits.

a) (4 marks) $\lim_{x \rightarrow \infty} x^2 e^{-x}$

b) (4 marks) $\lim_{x \rightarrow 0^+} \frac{1}{2x} - \frac{1}{x}$

5. Determine whether the following improper integrals converge or diverge. Find the value of the integral if it converges.

a) (5 marks) $\int_0^{\infty} \frac{1}{\sqrt{x}} \, dx$

b) (5 marks) $\int_0^1 \frac{dx}{2x^3}$

6. (5 marks) Find the arc length of the graph of the function $y = \sqrt{x}$ on $[0, 1]$.

7. (5 marks) Find the area of the region bounded by the graphs of the functions $y = 2 - x^2$ and $y = x$.

8. (5 marks) Use the _____ method to find the volume of the solid obtained by rotating the region bounded by the graphs of $y = \sqrt{x}$, $y = x$ about the line $y = 0$.

1a. $\frac{1}{2} \sin x^2 - 1 + C$

1b. $\arctan x - 1 + C$

1c. $\ln|x| - \ln|x-2| - \frac{1}{x-2} + C$

1d. $\frac{1}{5} \sec^5 x - \frac{1}{3} \sec^3 x + C$

1e. $\frac{1}{4} x^4 - \frac{1}{4} \ln x + C$

1f. $-\frac{\sqrt{x}}{x} + C$

2. $\frac{2}{3}$

3. $4x\sqrt{3-4x^4}$

4a. 0

4b. e^2

5a. 2

5b. $\frac{1}{4}$

6. $-\frac{1}{2}$

7. $\frac{9}{2}$

8. $\frac{1}{6}$

9. $\frac{1}{5}$

10a. Divergent

10b. Convergent

10c. Convergent

11. $P(x) = 1 - 2x + \frac{3}{2}x^2 - \frac{2}{3}x^3$

12a. $\frac{82}{3}$

12b. 1